

# Indoor Air Quality

## Asbestos

## Lead-Based Paint

## Radon



# Radon Is An Equal Opportunity Hazard!

- Radon in homes can present an unhealthy environment.
- Radon concerns are not dependent upon the age of a home.
- Radon concerns affect expensive and affordable homes alike.
- 2<sup>nd</sup> Leading Cause of Lung Cancer

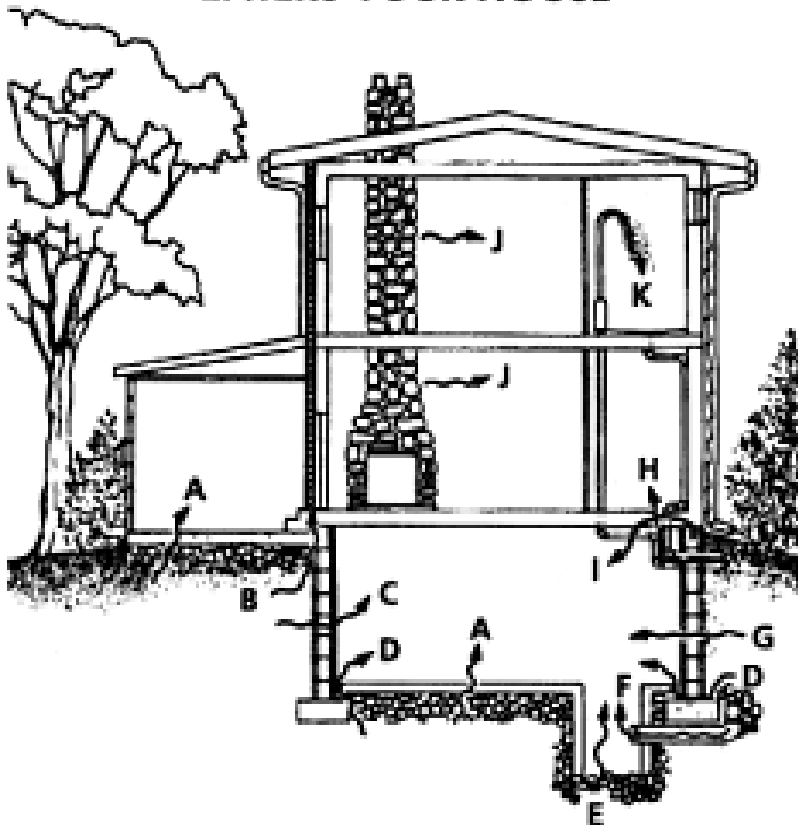
***We believe that healthy environments  
should be accessible to all!***

# Where Does Radon Come From?

- Radon comes from the breakdown of Uranium that is found in the soil.
- Radon is drawn into a building or home through cracks, pipe chases, and other openings.
  - Facilitated by mechanical exhaust fans and thermal stack effect

# Radon Entry Points

**HOW RADON  
ENTERS YOUR HOUSE**

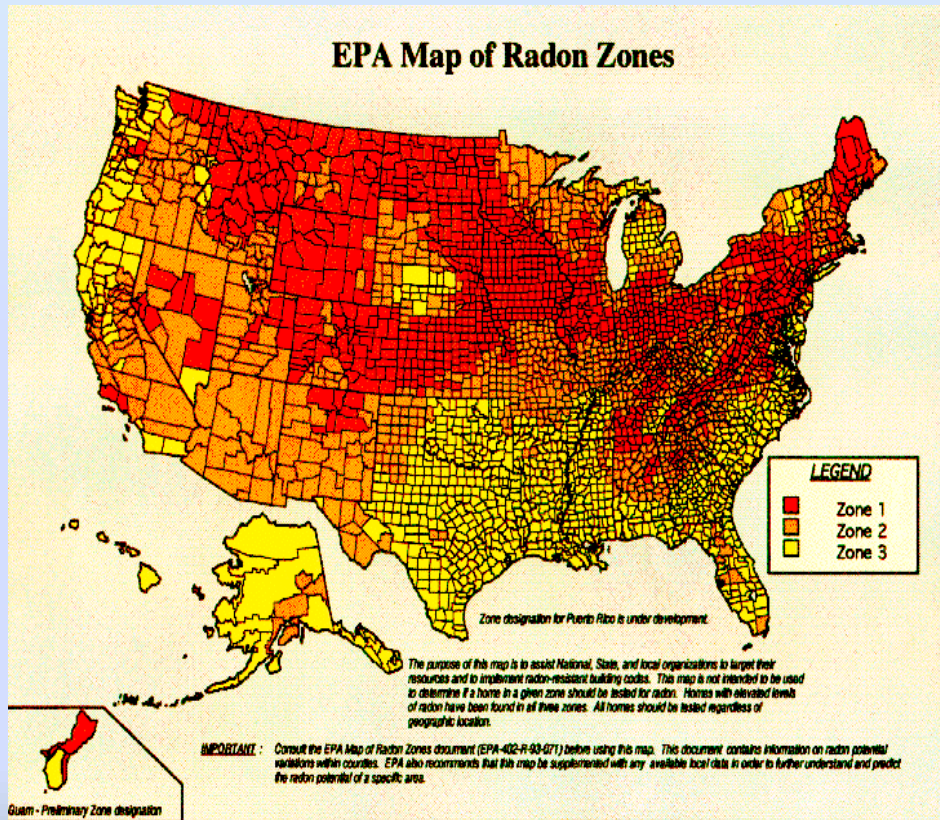


- A. Cracks in concrete slabs**
- B. Spaces behind brick veneer walls that rest on uncapped hollow-brick foundation**
- C. Pores and cracks in concrete blocks**
- D. Floor-wall joints**
- E. Exposed soil, as in a sump**
- F. Weeping (drain) tile, if drained to open sump**
- G. Mortar joints**
- H. Loose fitting pipe penetrations**
- I. Open tops of block walls**
- J. Building materials such as some rocks**
- K. Water (from some wells)**

# Radon Facts

- Radon breaks down and emits radioactive decay products.
- Half life of 3.8 days
- Average Indoor radon levels = 1.3 pCi/L
- Average Outdoor radon levels = 0.4 pCi/L
- EPA lists a Radon level of 4 pCi/L as the recommended level to take action.

# What Areas Can Most Benefit?



- Based on geology and surveys

- Expected closed building radon (pCi/L):

- Zone 1: 4.0 and above

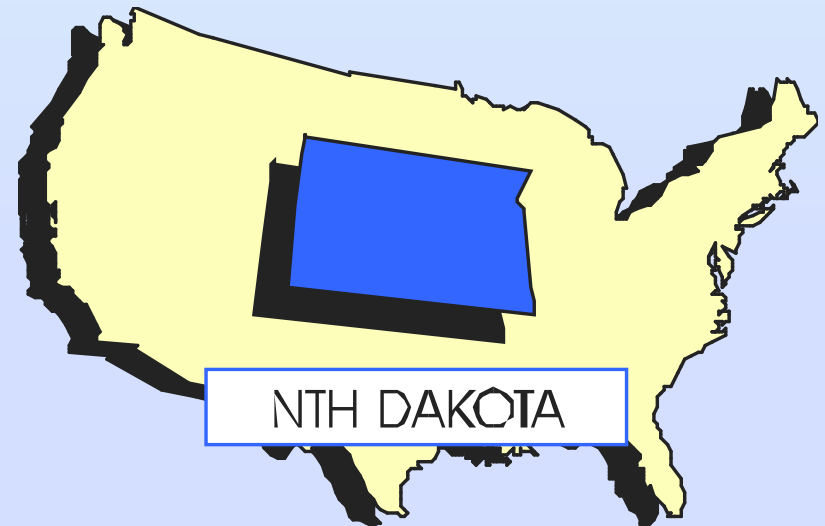
- Zone 2: between 2.0 & 4.0

- Zone 3: 2.0 and lower



# North Dakota Statistics

- All ND counties are Zone 1.
- 63% of homes in ND test over 4pCi/L
- There are no regulations for Radon in ND.



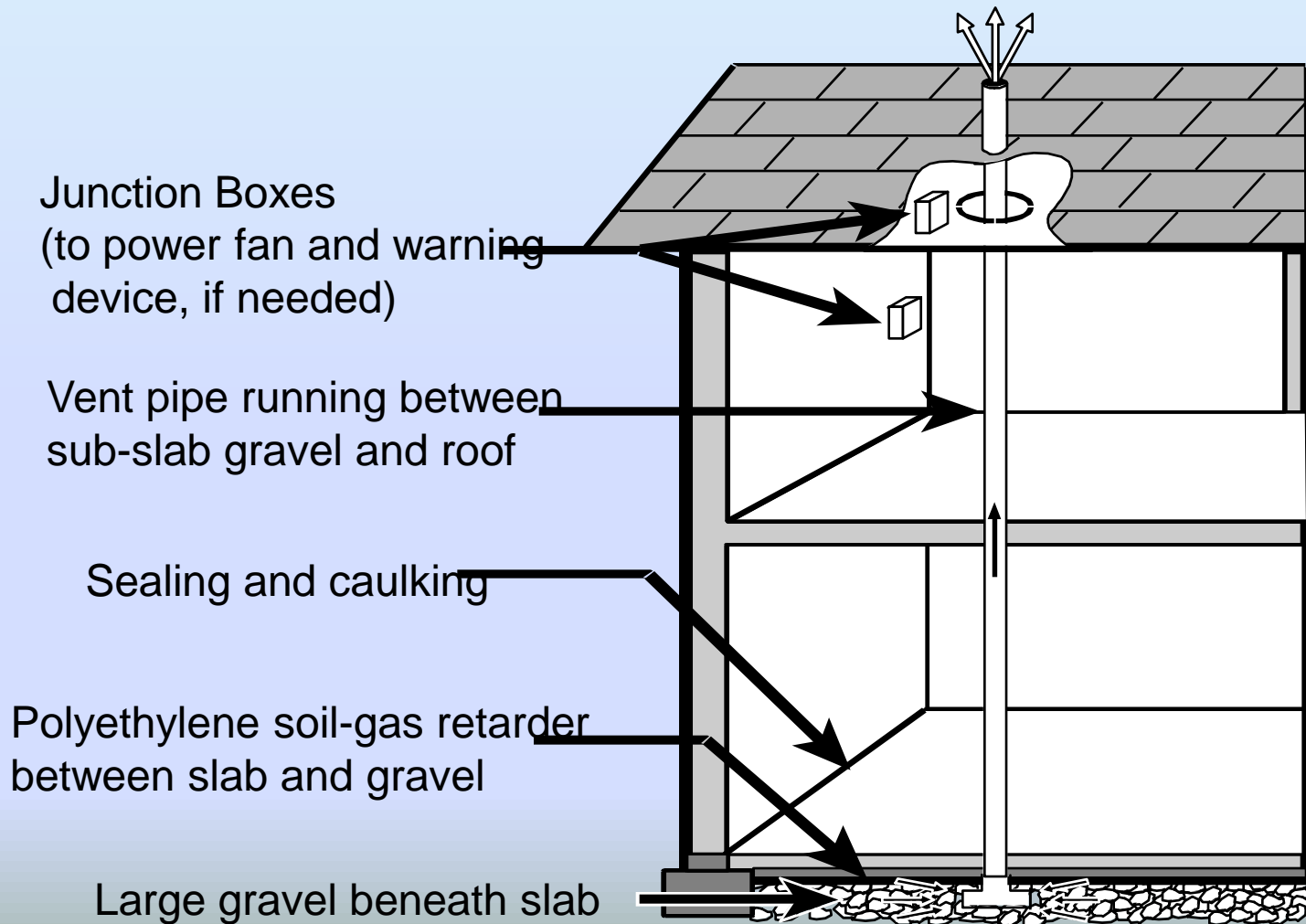
# What Can We Do?

- Build RRNC Housing & Commercial Buildings!





# Basic Components of Passive System



# Other Benefits Of System

- Moisture Reduction
  - Soil moisture is vented through system.
  - Reduces mold and mildew, especially when activated.

# From the Ground Up

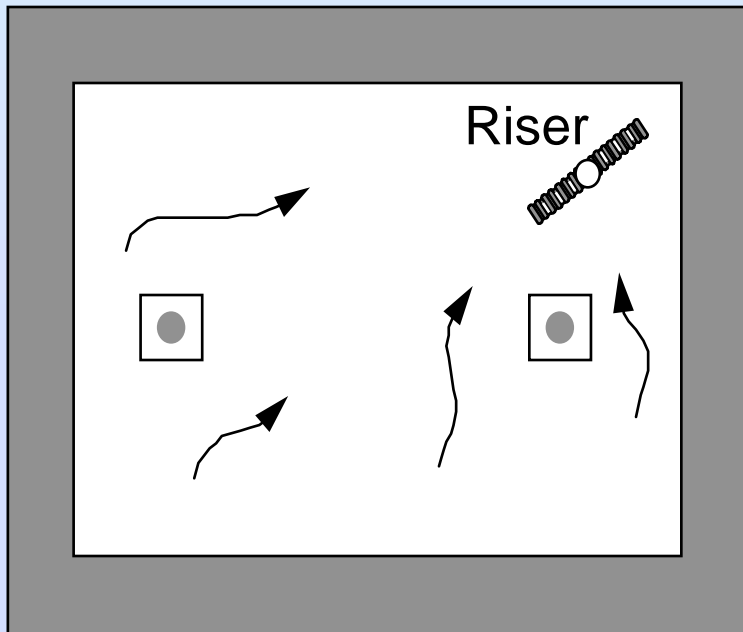


**Drain tile in gravel routed to sump hole under the slab.**

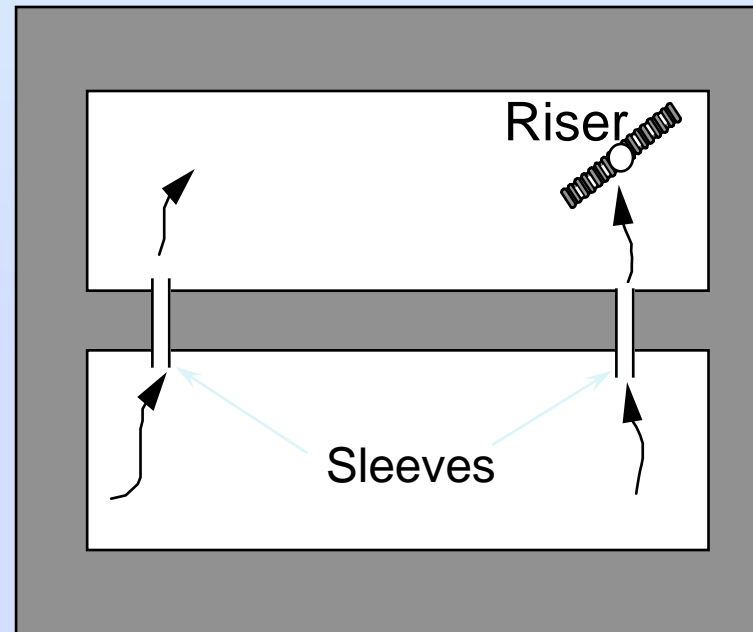
**The sump hole can be used as the collection point.**

# Aggregate Option: Allowing For Lateral Air Flow

**Post and Beam**



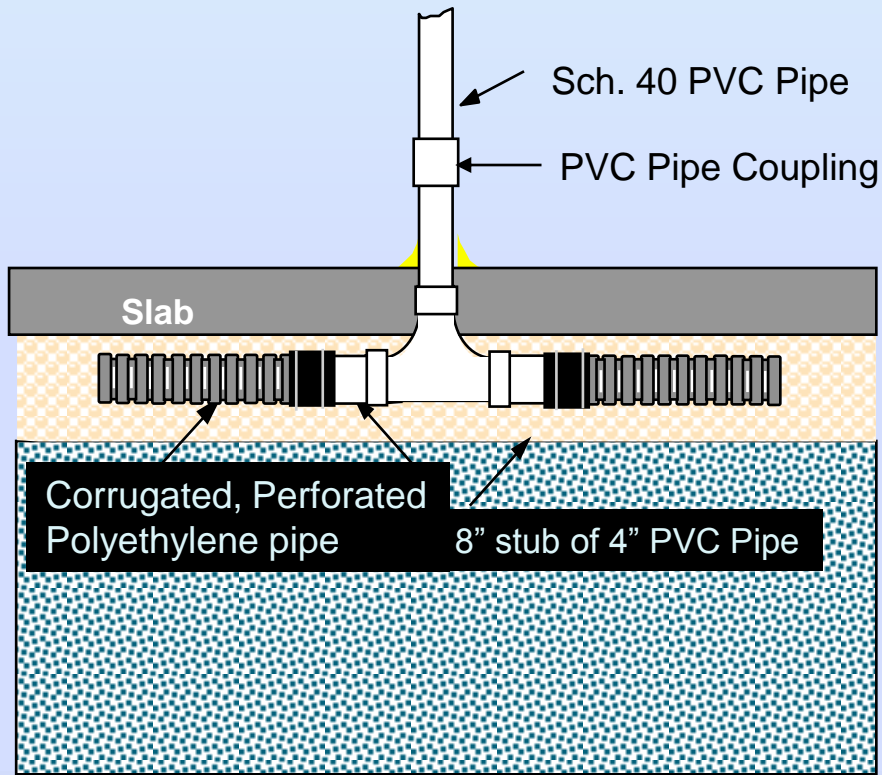
**Foundation with Grade Beam**



Minimum of two grade beam penetrations.

Minimum of 12 sq. inches of opening per 10 ft. of grade beam.

# Aggregate Option: Connecting Gravel To Vent Pipe



- Connect vent pipe to aggregate layer.
- Tee beneath slab connected to 5 feet of perforated pipe on each leg.
  - Tee and perforated pipe same diameter as vent pipe.



# 6 mil Polyethylene Sheeting



# Routing Vent Pipe

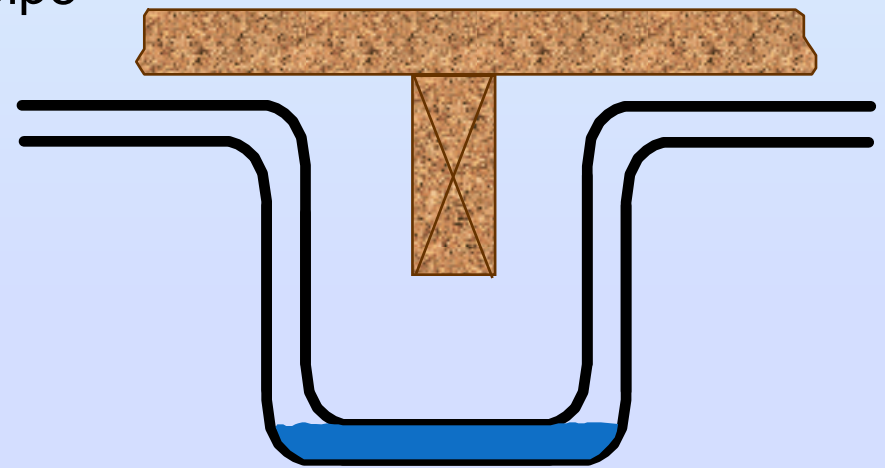
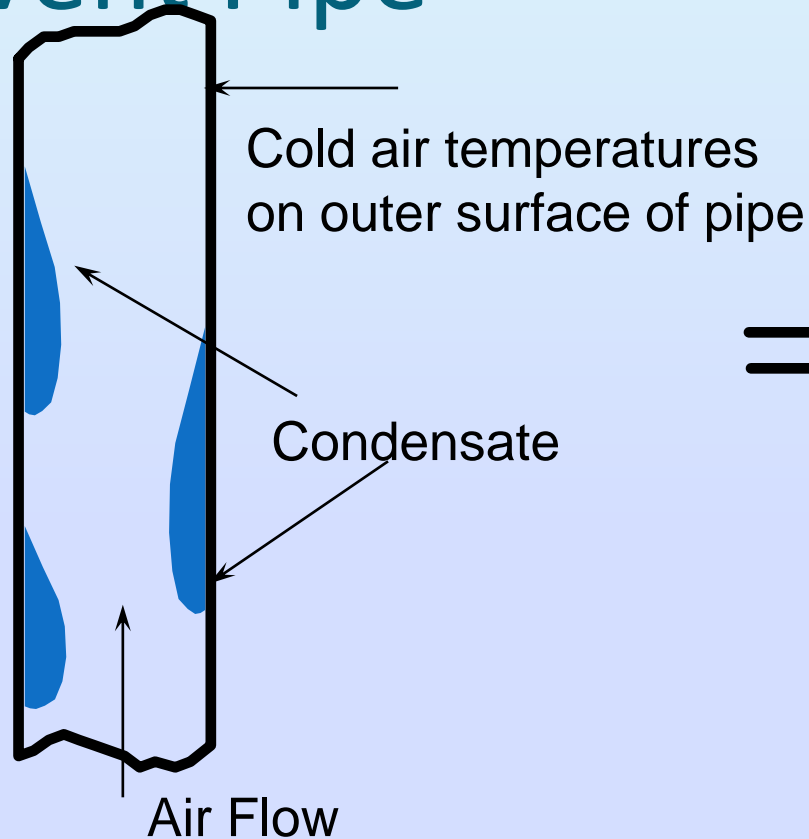


Hide in chases and walls



Route along side flue for maximum stack effect

# Allow For Condensation In Vent Pipe



Traps will fill with water

- Install pipe horizontally and vertically
- No Traps!



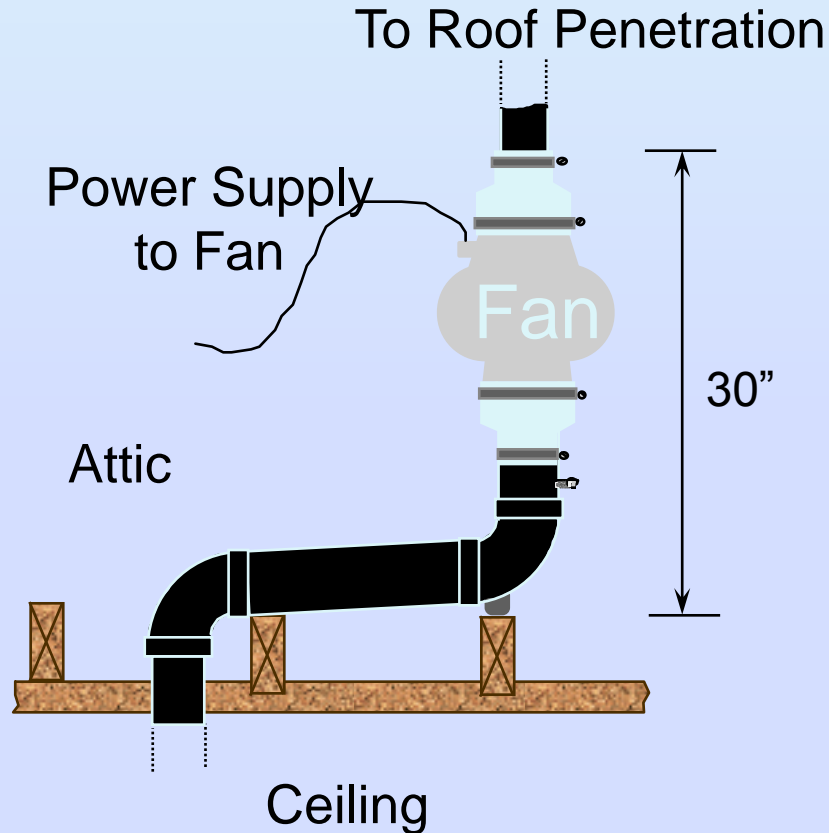
# Make Provisions To Allow For System Activation



**-Electrical box for future fan.**

**-Allow enough space for fan.**

# Allow For Potential Fan Installation



- Plan for fan to be in attic or garage
  - Cannot be inside living space or crawl space.
- Allow 30 inches of vertical run
- Install duplex within 4 feet



# Discharge End



- Penetrate roof decking before shingles installed
- Put rodent screen on end

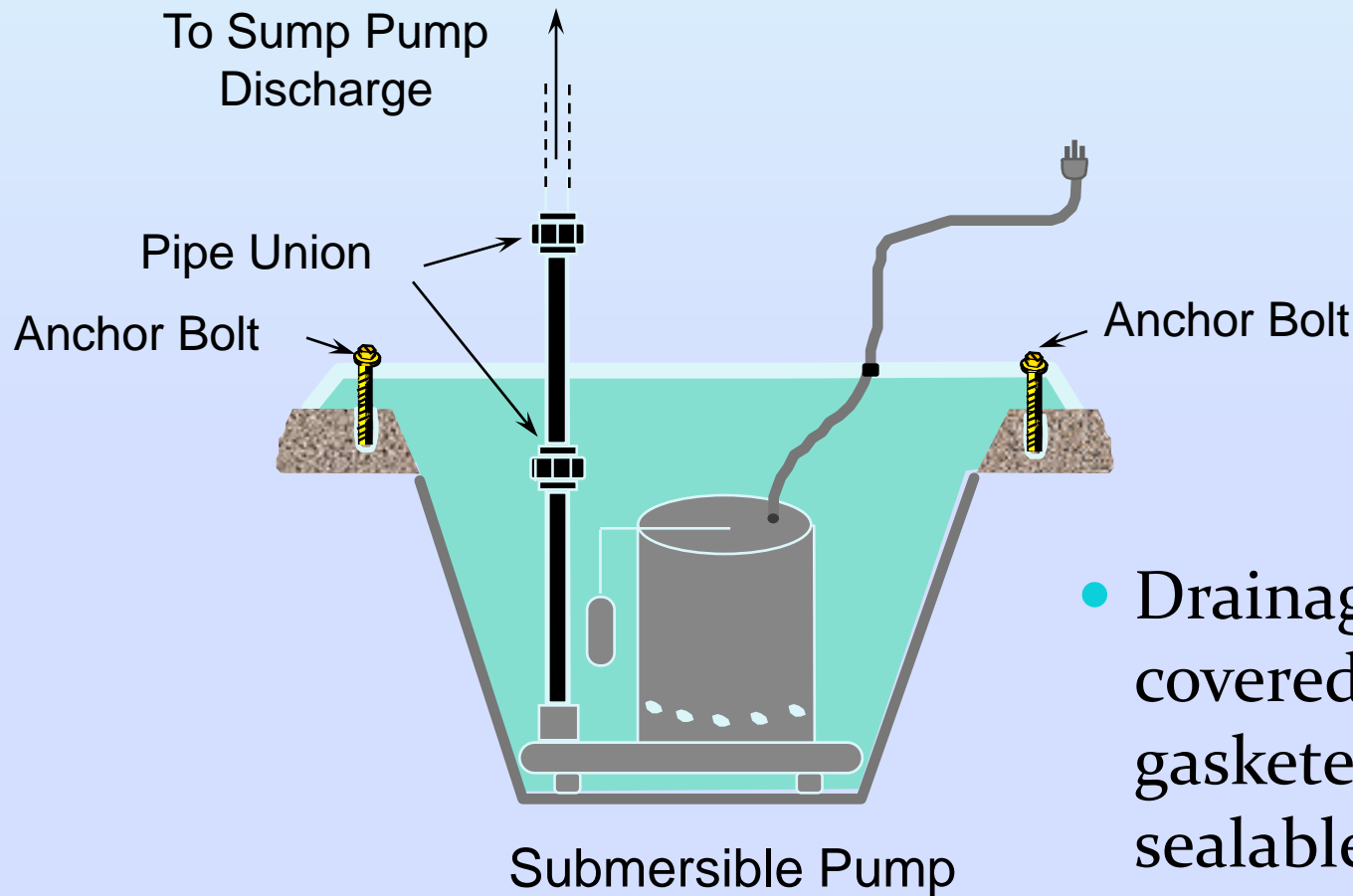


# System Identification



- Label pipe at each level of building that it can be seen.
- “Radon Reduction System”.
- label as system is installed to avoid mistaking this with plumbing system.

# Cover Open Sumps



- Drainage sumps covered with gasketed or re-sealable lids.

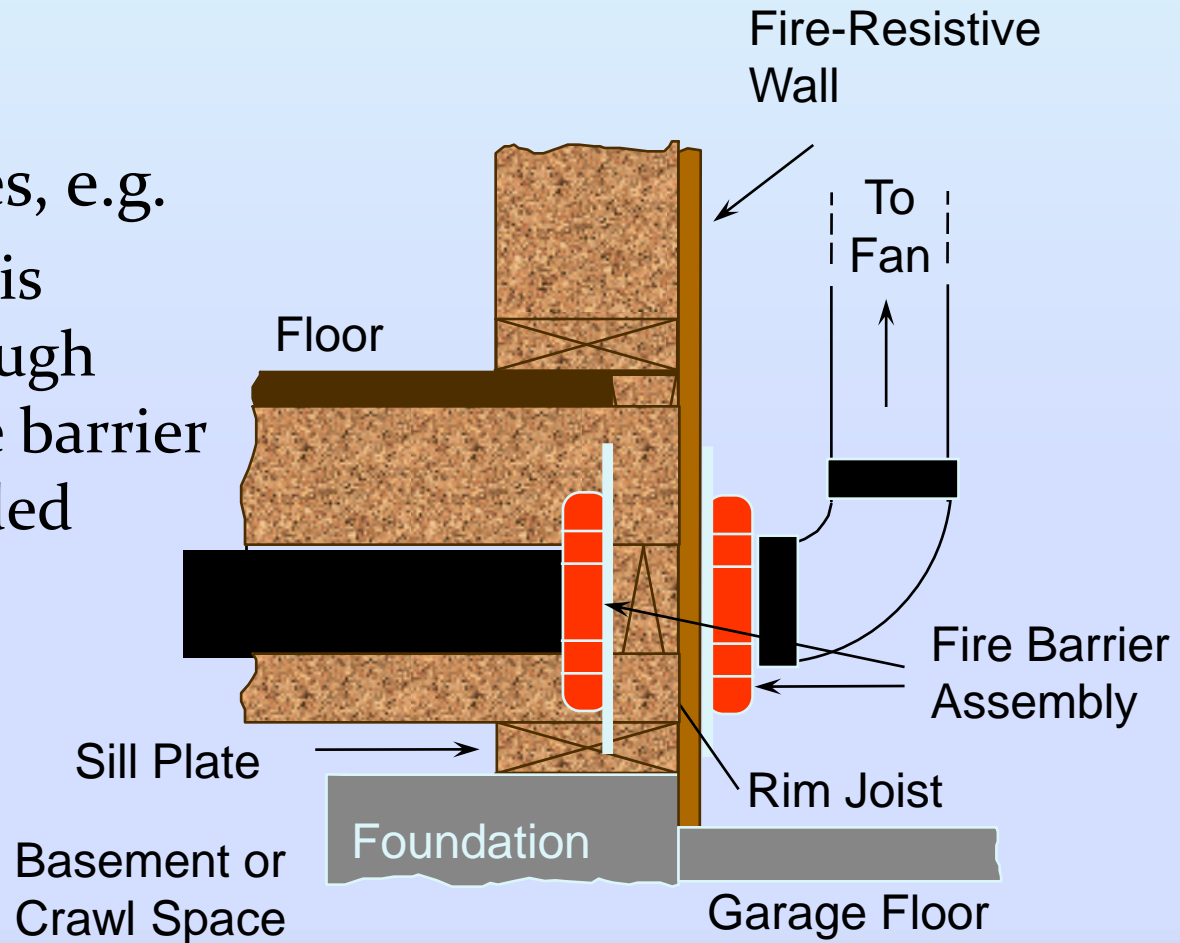


# Vent pipe sealed to sump cover.



# Follow Plumbing Codes For Pipe Installation

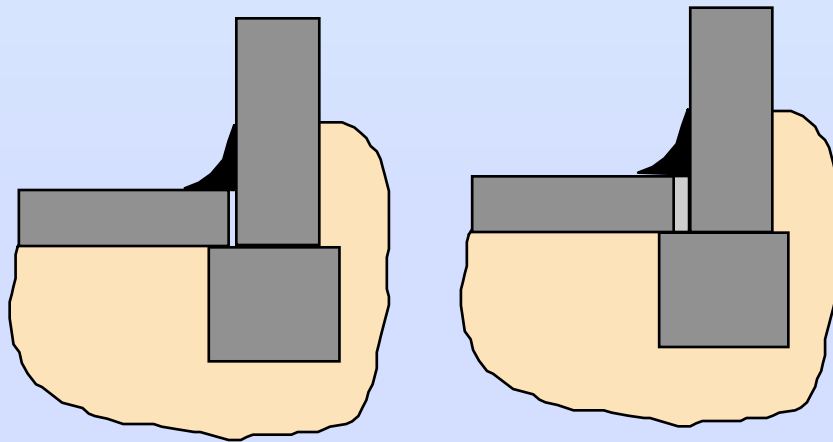
- Follow local building codes, e.g.
  - If vent pipe is routed through garage a fire barrier will be needed





# Sealing Slab Openings Improves Performance

## Sealing Slab Openings



Cold Joint

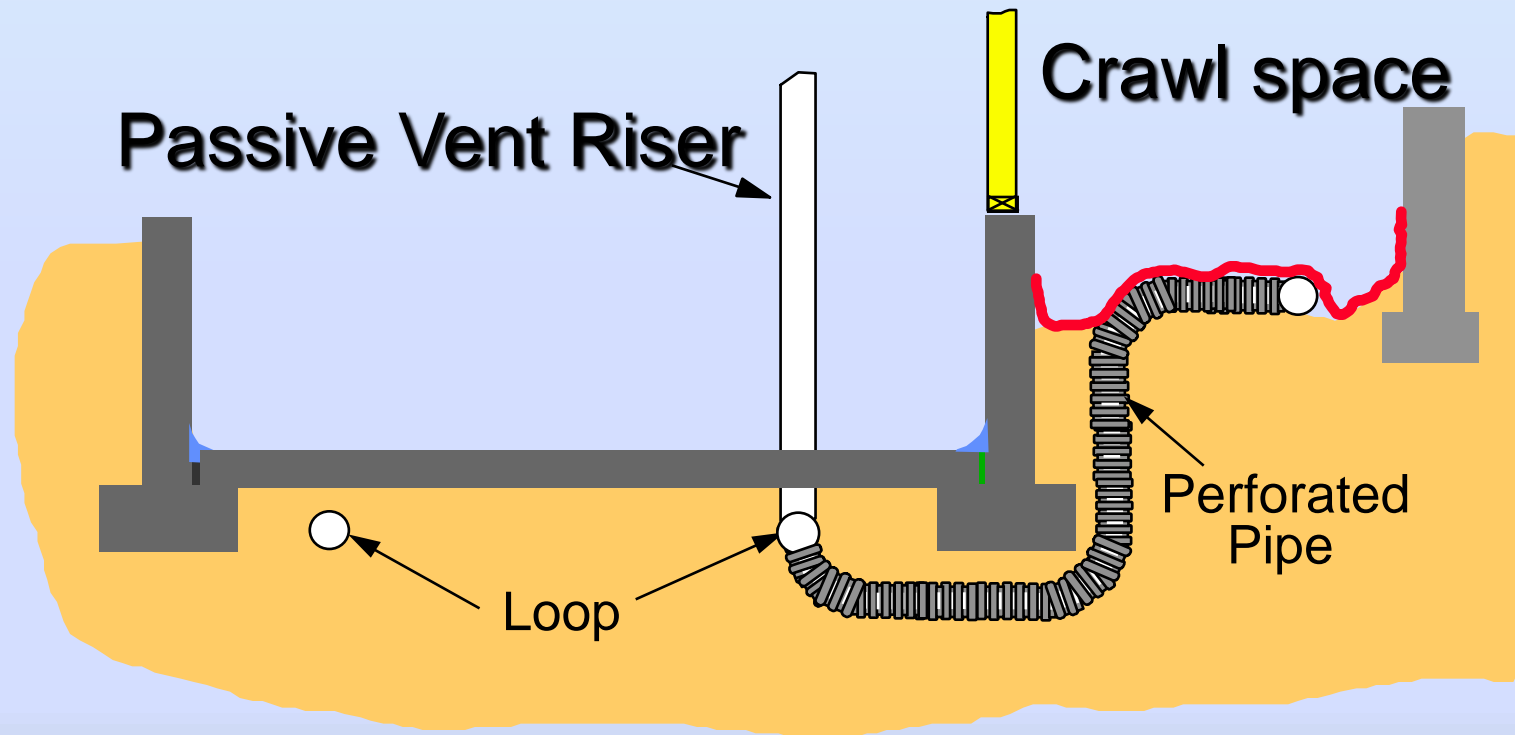
Expansion  
Joint

- Polyurethane caulk
- Cold joint
- Expansion Joint
- Control joint
- Plumbing penetrations

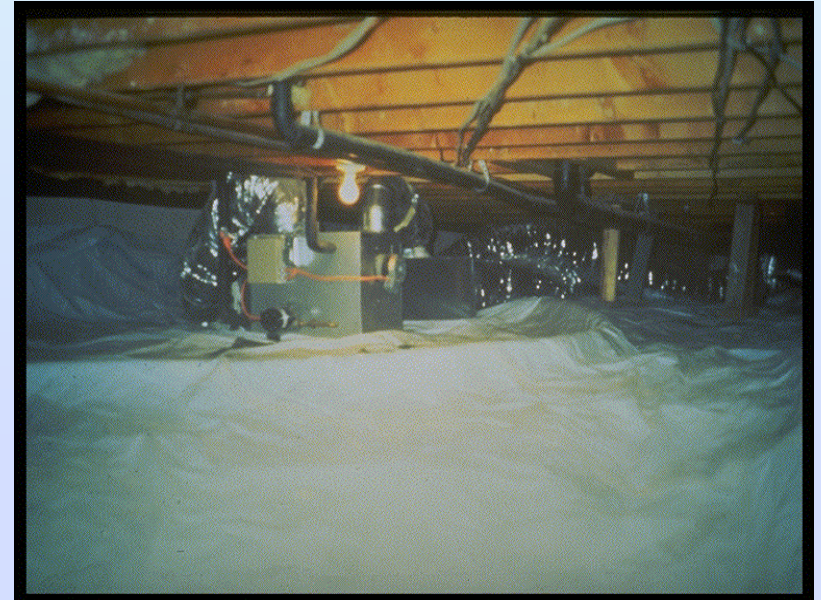
# Other Entry Routes That May Already Be Addressed By Local Codes

- Plumbing block outs for tubs and showers.
- Slab control joints.
- Hollow cores of block walls filled, capped, or otherwise blocked from allowing air movement up through them.
- Damp-proofing exterior, below grade walls.

# Multiple And Combination Foundations



# Treating Crawl Spaces



- Length of perforated pipe on soil
- High density, 4 mil. cross-linked polyethylene
- Seal to walls, seams and at pads

# Prep Walls And Apply Caulk



Brush debris off wall



Apply polyurethane caulk  
8 feet/11 oz. tube



# Install Plastic



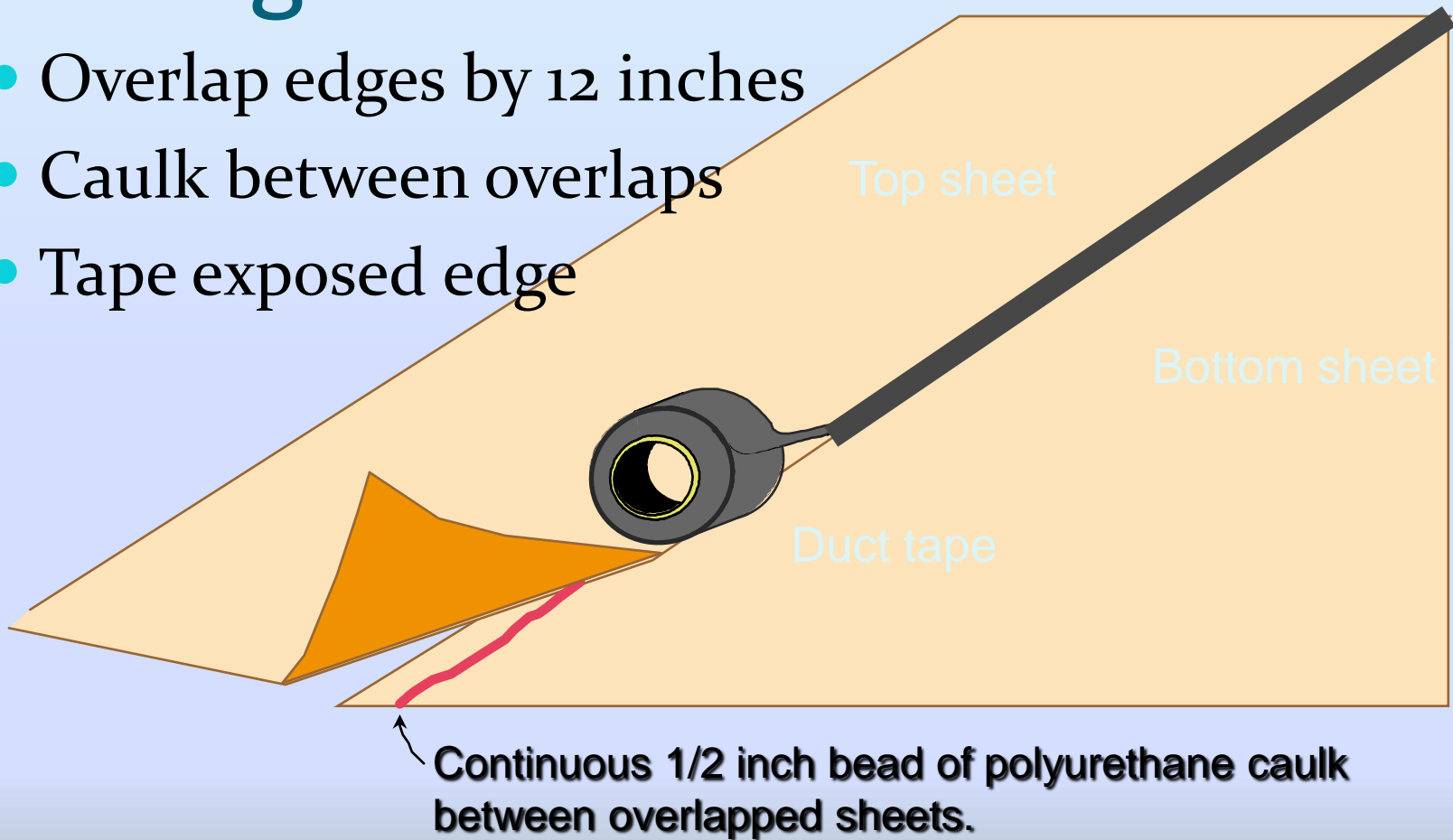
Apply plastic



Press into plastic  
Secure edges with duct  
tape until caulk cures

# Sealing Seams

- Overlap edges by 12 inches
- Caulk between overlaps
- Tape exposed edge



# Crawl Space Riser



- Seal plastic to riser with two sandwiched roof jacks
- Label riser

# Large Building Aspects

- Schools
- Multi-family dwellings
- Commercial buildings

Same concept - just more of it!

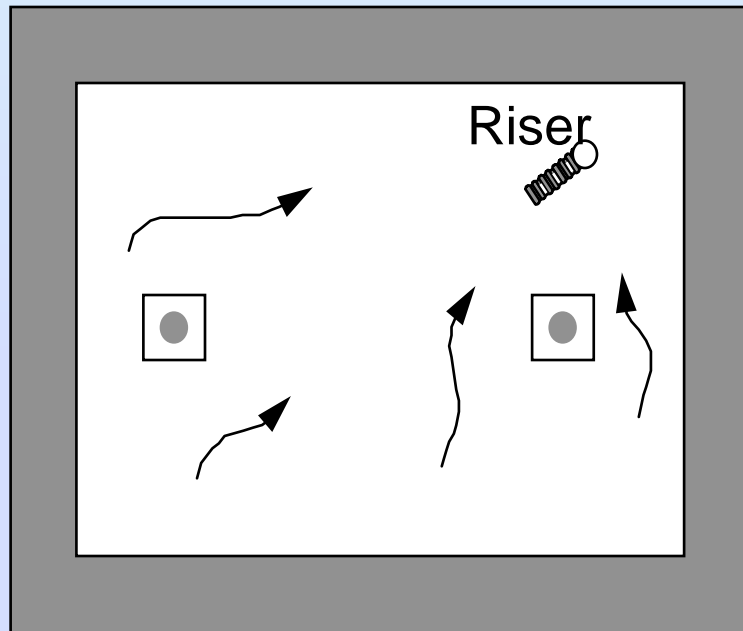


# Slab Design: Aggregate Option

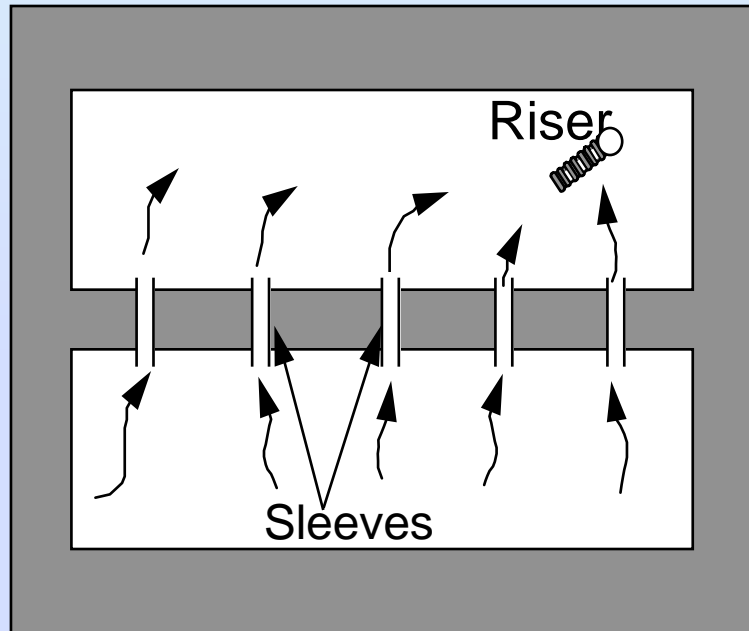


- Nominal 4 inches of 3/4 in. clean gravel
- Means for restricting mud from entering gravel
  - Plastic
  - Two more inches of gravel

# Aggregate Option: Allowing For Lateral Air Flow



Plan View  
Post and Beam



Plan View  
Foundation with Grade Beam  
For Bearing Wall

# Methods To Allow Transverse Air Flow Through Footings



Foam Block-Outs in Forms

cvc<sup>©</sup>



Alternating Turned Blocks in  
Foundation Wall Below Slab



# Pits For large Buildings



Expanded Metal With Deck



Radon Vent Pipe Connected  
& Gravel Spread. Concrete poured  
on top.



# Large Buildings

## Post-Tension Slabs

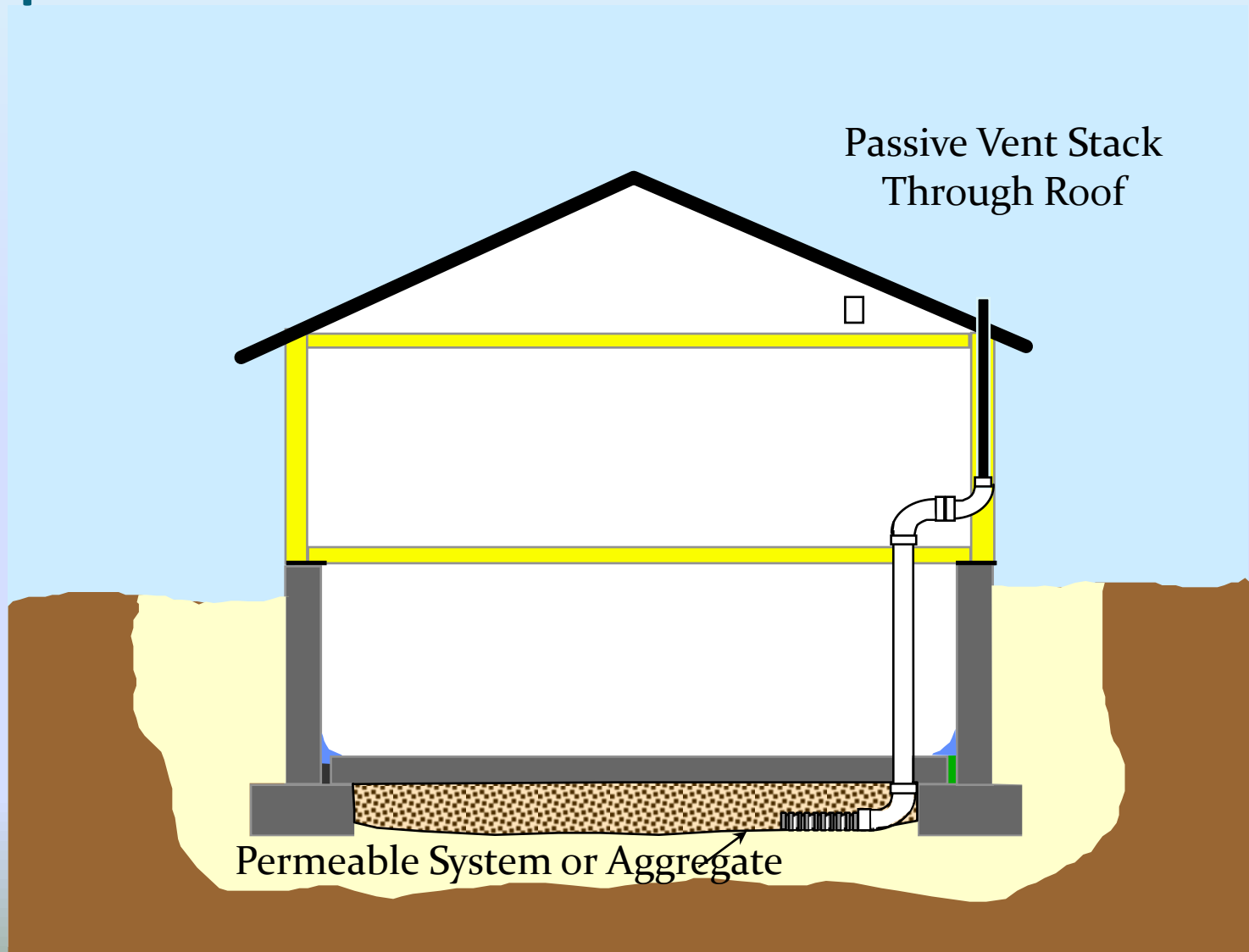


- Large areas covered by mat.
- Lay mat after grade beams poured and sub-grade compacted but prior to pouring slab.

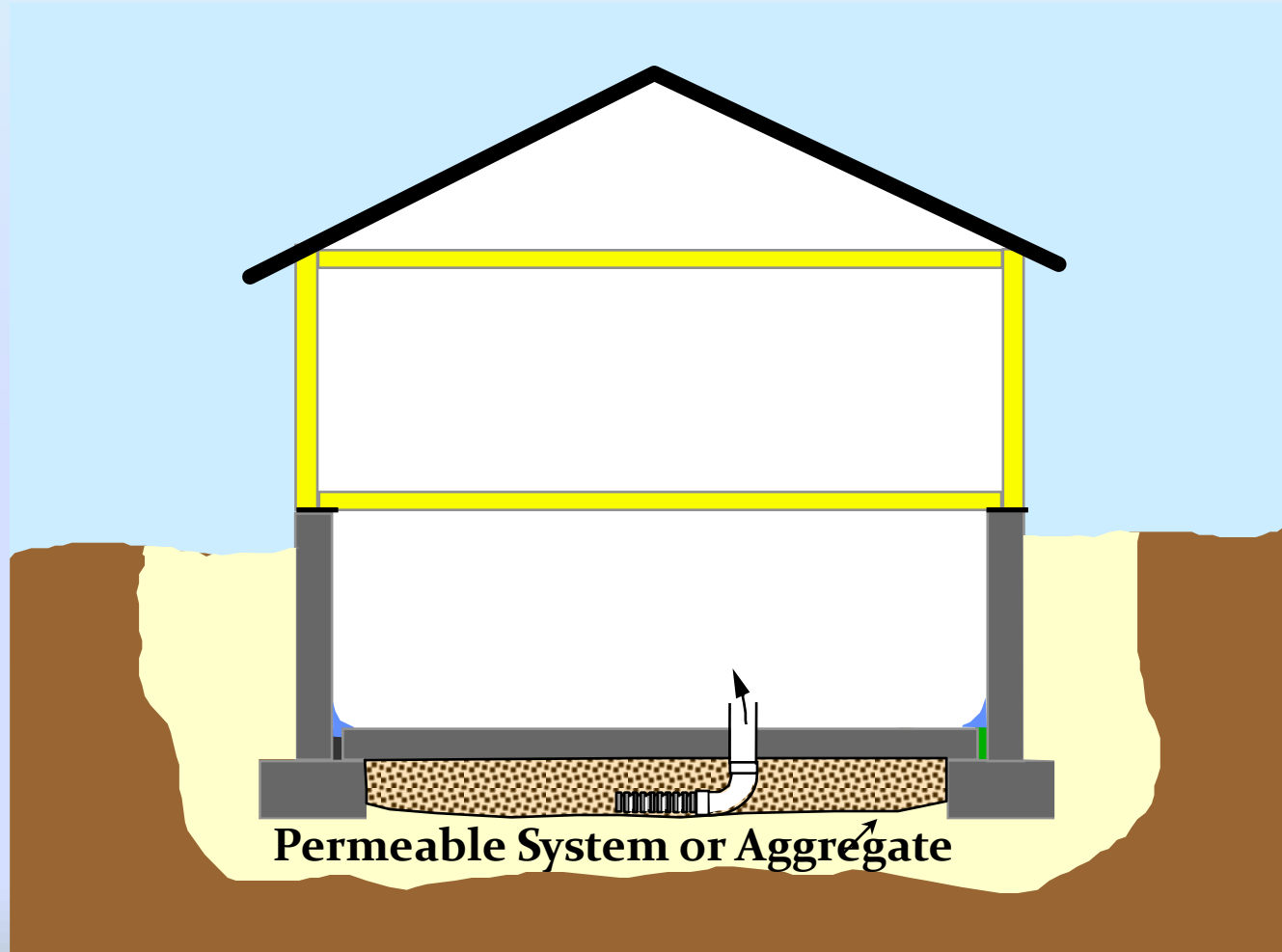
# Post Construction Testing And System Disclosure

- The proposed methods are prescriptive - not performance based.
- Testing is better performed after occupation.
- The need for further reductions is the decision of occupant.
- Disclosure should be made to occupant (and future occupant) of systems existence and need to test to verify efficacy.

# What is wrong with this picture?

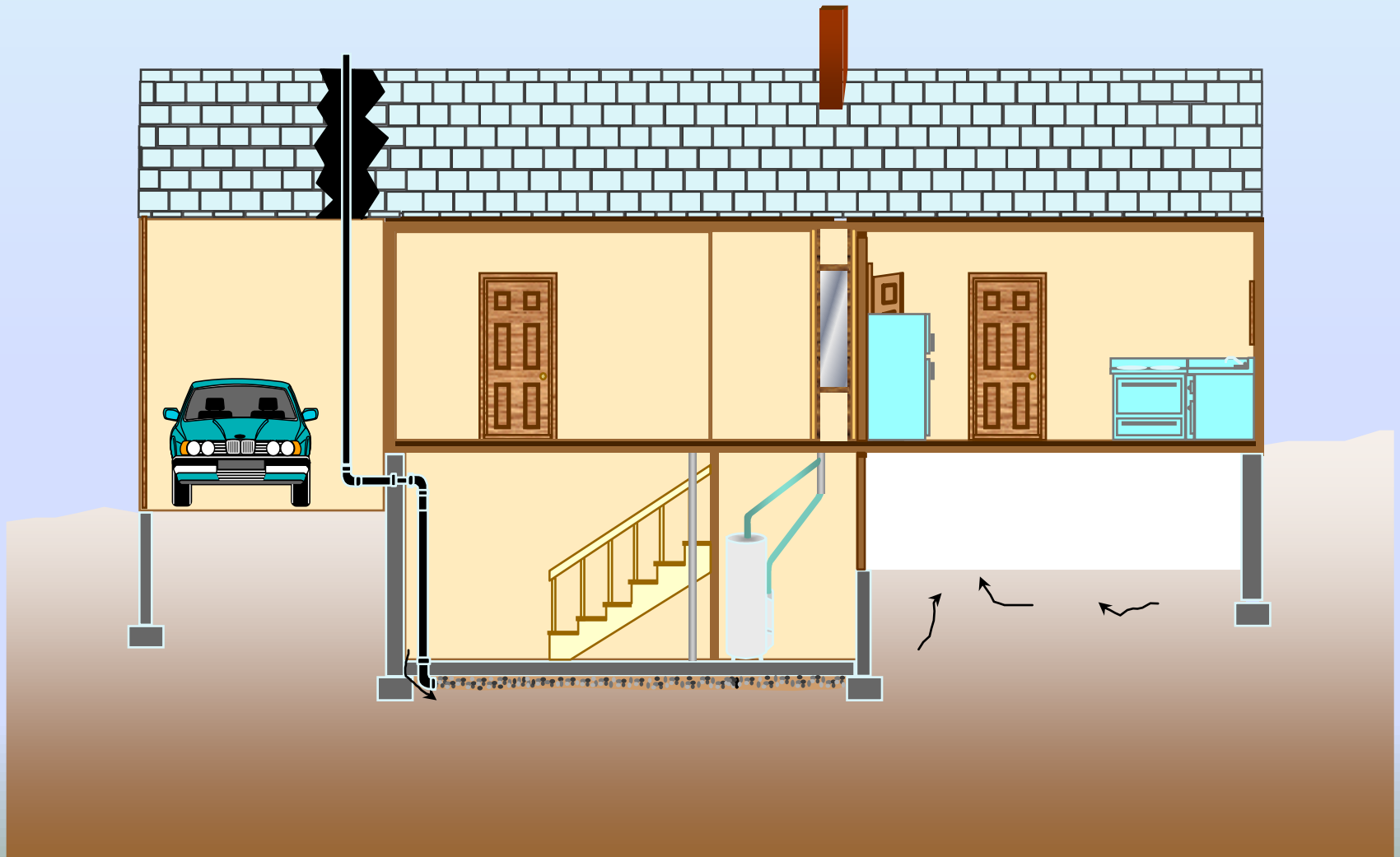


# What is wrong with this picture?





# What is wrong with this picture?



# Indoor Air Quality



# Good IAQ

- Ventilation
- Dry House
  - Mold can only grow if it has moisture & food source!!
- Maintenance
- Cleaning
- Comfort is sometime mistaken as an IAQ problem.

# Ventilation & Humidity

- Air to Air exchanger
  - Required in some states
  - Residential - 2009 International Building Code & International Residential Code
  - Commercial = ASHRE Standards
    - [www.ashrae.org/home/](http://www.ashrae.org/home/)
- Humidity
  - Under 50% to prevent mold & control dust mites
  - Above 30% in cold climates



# Mold



# Preventative Measures

## Remedy Issues Quickly



- Fix Broken Items Quickly (Pipes, Windows, Vents)
- Clean/Remove Unsanitary Conditions (Water/Sewer)
- Discard Damaged Materials
  - Insulation (National Insulation Manufacturer's Assn. recommends replacement if wet)
  - Carpeting
  - Books, Papers, etc.
  - Ceiling Tiles
  - Keep Construction Material Dry!!!

# Mold Testing

- Types
  - Bulk, Surface, Air ... viable vs. non-viable
- Not Recommended as a First Step
  - May Not Be Necessary If You See Mold, If You Smell Mold, or If There are Past or Ongoing Moisture Control Problems
  - There Are No Uniform Quantitative Standards, Guidelines or Recommendations for Sampling, Sample Analysis, or the Interpretation of Results
  - Should Be Done by Experienced Professional

# Mold Cont...









# Follow Important Guidelines For Construction/Renovation

- Considerations to Minimize Indoor Pollutants:
  - Select low emitting products / materials
  - Select mold resistant products
- Scheduling:
  - allow wet materials to dry / cure before installing porous materials
    - secondary sources or sinks
    - , and before re-occupancy (paints, adhesives)
- Clear air before occupancy
- Flush out if necessary



# Lead-Based Paint (LBP)

## Two LBP Regulations:

### 1) EPA-Renovation, Repair and Painting (RR&P)

- Impacts pre-1978 housing and child-occupied facilities.
- Includes anyone receiving compensation to conduct work on target housing or child-occupied facilities that impact a coated surface(paint, varnish, etc...).
- General contractors, electrical, specialize cleaning companies, etc.
- Requires Contracting Firm to have:
  - Firm License (Certification) from EPA
  - Individual trained as a “Certified Renovator” in LBP safe work practices.

# LBP-RR&P



# Lead-Based Paint

## 2) North Dakota LBP Abatement regulations/program

- Adopted EPA's 40 CFR 745 and part's HUD's LBP regulations under 24 CFR part 35
  - federal funding (HUD)
- ND Licensed firms, certified individuals, accredit training providers for abatement, testing & risk assessment
- Inspection of work sites, record review and audit of training providers.

\*EBL investigations and maintain blood lead database tracking system

\*All pre-1978 Housing and Child-Occupied Facilities



# LBP – Abatement





# Asbestos In Housing & Commercial

- Asbestos
- Regulated by ND
  - Standards for handling and disposal of asbestos containing material (ACM) during renovation and demolition activities
  - Certification of individuals & firms
  - Inspections
    - Commercial
  - Approve demolition of facilities
    - Flood buy outs, condemned & abandon buildings, fire & flood damage bldgs, Renovation work etc..
    - Notification requirement



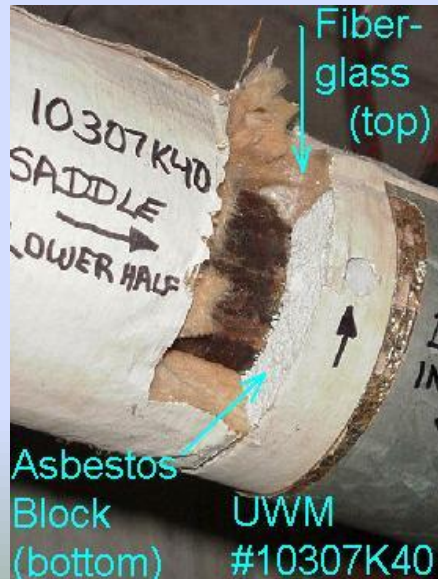
# Uses For Asbestos

Extensively used between 1920 & 1978

- Thermal insulation (pipes, boilers, ducting)
- Fireproofing (sprayed-on beams and pillars)
- Acoustical and decorative plaster (sprayed or trowled)
- Cement-type products (transite siding, shingles, wallboard & pipe)
- Asphalt roofing materials
- Vinyl floor coverings (tile & linoleum)
  - 3,000 different types of commercial products contained asbestos ( 1984 study)

# Uses of Asbestos

## Thermal System Insulation

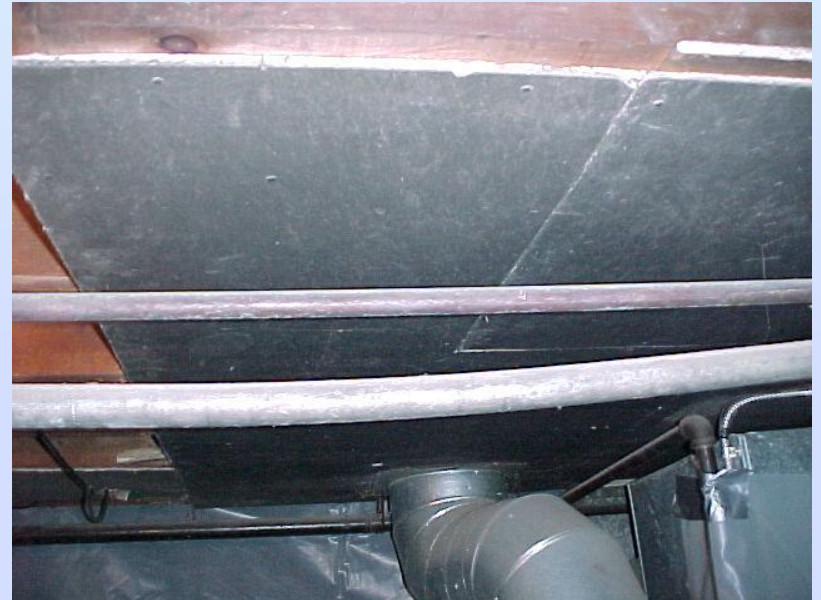


# Uses of Asbestos

(nonfriable materials)



9" floor tile  
(Category I)



Transite panels  
(Category II)

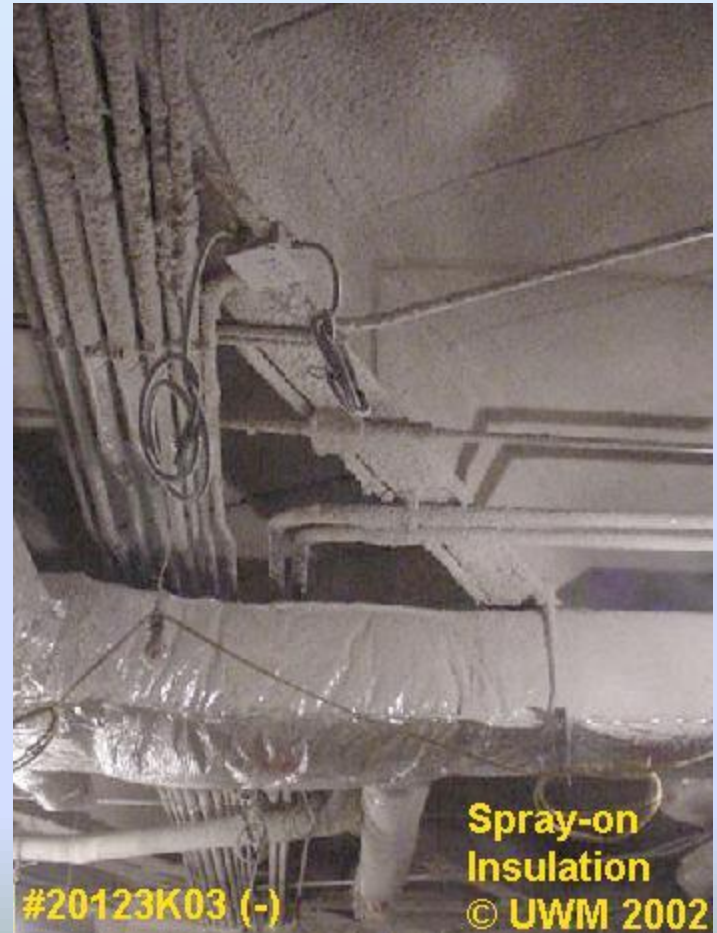


# Uses of Asbestos

(surfacing materials)



“popcorn” ceiling





# Vermiculite

\* Zonolite – Insulation



- Robinson Insulation Company in Minot
  - ( 1947-1983)
- Libby Montana Mine
  - Produce 80% of vermiculite
  - 14,000 ton shipped to Minot
  - Termolite asbestos

# Vermiculite



# General Requirements

- All affected parts of a facility being renovated or demolished must be inspected for the presence of asbestos-containing materials (ACM) prior to beginning the renovation or demolition project. The inspector must be certified through this Department.
- **Facility - means any institutional, commercial, public, industrial, or residential structure, installation, or building (excludes residential buildings having four or fewer dwelling units)**
  - Flood buy out homes are regulated.

# General Requirements Cont.

- All regulated asbestos-containing material (RACM) that would be disturbed as part of a renovation or demolition must be properly removed before beginning the project.
- RACM includes all friable (when dry can be crumbled, pulverized or reduced to powder, by hand pressure or by mechanical forces expected to act on the material) ACM and nonfriable ACM that will be made friable during the project.
- Proper removal includes emission control techniques such as containment and wet methods.

# General Requirements Cont.

- A "Notification of Demolition and Renovation" form must be submitted 10 days prior to beginning the following activities:
  - **A facility being demolished. This is required even if the facility does not contain asbestos**
  - **A facility being renovated, where more than 160 square feet of asbestos-containing surfacing material, or more than 260 linear feet of asbestos-containing thermal system insulation on pipes will be disturbed.**



# Websites

- RRNC

<http://www.ndhealth.gov/AQ/IAQ/RADON/mitigation>

<http://www.epa.gov/radon/rrnc/index.html>

- IAQ

<http://www.ndhealth.gov/AQ/IAQ/>

<https://www.ashrae.org/standards-research--technology/standards--guidelines>

<http://iac2.org>

- LBP

<http://www.epa.gov/lead/>

<http://www.ndhealth.gov/aq/iaq/lbp>

- Asbestos

<http://www.ndhealth.gov/AQ/IAQ/ASB>

# Contact Information

## Radon, Asbestos, IAQ & LBP Programs

Justin Otto

Jane Kangas

Sandi Washek

(701)328-5188